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# A preliminary cross-cultural study of Hikikomori and Internet Gaming Disorder: The moderating effects of game-playing time and living with parents

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## ABSTRACT

**Background:** Internet Gaming Disorder (IGD) and Hikikomori (an extreme form of social real-life withdrawal, where individuals isolate themselves from society) have both been suggested as mental disorders that require further clinical research, particularly among young adult populations.

**Objective:** To add to the extant literature, the present study used a cross-cultural, cross-sectional design to investigate the association between Hikikomori and IGD, and the potential moderating effects of reported game-playing time and living with parents.

**Method:** Two online samples of 153 Australian and 457 U.S.-North American young adult players of Massively Multiplayer Online (MMO) games were collected. The nine-item Internet Gaming Disorder Scale-Short Form (IGDS-SF9), and the Hikikomori Social Withdrawal Scale were administered to dimensionally assess IGD and Hikikomori, respectively.

**Results:** Linear regression analyses confirmed that Hikikomori symptoms are associated with IGD. Additionally, moderation analyses indicated that the association was exacerbated by longer game playing time across both populations. Gamers living with their parents was a significant moderator of the relationship for the Australian sample.

**Conclusions:** Extreme real-life social withdrawal and IGD are related, and this association is exacerbated for those who spend more time playing MMOs per day, and, for Australian participants, living with their parents.

## 1. Introduction

### 1.1. Internet gaming disorder

Internet use (IU) has considerably expanded worldwide over the past two decades (Poushter, 2016) with gaming presenting as a highly popular online activity (Perron & Duggan, 2015). Among young adults (18–29 years), IU is elevated (Arnett, 2000), with 80% reporting online gaming involvement (Brand & Todhunter, 2016). Excessive online gaming can be associated with a form of behavioural addiction classified as *Internet Gaming Disorder* (IGD) among vulnerable players (American Psychiatric Association, 2013).

According to the fifth edition of the *Diagnostic and Statistical Manual*

for Mental Disorders (DSM-5), IGD was listed in Section 3 as a condition that requires further study and refers to “persistent and recurrent use of the internet to engage in games (8–10 h of gameplay per day, and at least 30 h per week), often with other players, leading to clinically significant impairment or distress” over a 12-month period (APA, 2013, p. 795). IGD has been described by many scholars as an addiction because it comprises common addiction features such as salience, mood modification, tolerance, withdrawal, interpersonal and intrapsychic conflict, and relapse (e.g., Griffiths, 2005; Poli, 2017) and has been associated with loneliness, low self-worth, poor social skills and social acceptance, poorer wellbeing, dysfunctional coping, and psychopathology (Kuss et al., 2017; Kuss & Griffiths, 2012; Liu & Peng, 2009; Rehbein, Kühn, Rumpf, & Petry, 2016). A deeper understanding of IGD’s

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etiology has become imperative (Petry et al., 2014), yet the extant knowledge considering IGD risk and protective factors is limited, prompting DSM-5 to recommend a specific focus on this proposed disorder (APA, 2013). However, it has been demonstrated that not all excessive gaming can be classified as an addiction and that contextual factors are key (Griffiths, 2010a). Furthermore, e-sports (i.e., professional videogame playing) involve organized multiplayer competitions between professional players who spend significant amount of time honing their skills in playing videogames in preparation for national and international competitions (Bányai, Griffiths, Király, & Demetrotics, 2018; Hamari & Sjoblom, 2017).

Adolescents and young adults have been identified as a group that is more vulnerable to developing IGD (APA, 2013). Similarly, players of the Massively Multiplayer Online (MMO) game genre tend to report higher game-related addictive behaviours (Kuss & Griffiths, 2012). Based on these findings, and given the extensive focus of the available literature on adolescents (Anderson, Steen, & Stavropoulos, 2017; Stavropoulos, Kuss, Griffiths, Wilson, & Motti-Stefanidi, 2017b), the present study targets young adult players of MMOs in Australia and the United States (US).

### 1.2. Young adulthood

The period signalling the end of adolescence (18 years) and preceding young adulthood ( $\geq 30$  years) has been defined as emergent adulthood (Arnett, 2000, 2007). This critical transitional period is characterised by instability with changes in residence (e.g., moving out of the parental home), schooling, and entering the workforce. Disruptions during this time can negatively impact on an individual's view of the world, relationships with others, and personal identity formation (Arnett, 2000, 2007).

It has been demonstrated that the onset of lifelong mental disorders may occur during this developmental period (Adams et al., 2018). Furthermore, young adults display higher proneness to digital means of prevention and intervention than other age groups (Hollis et al., 2017). Unsurprisingly, young adults additionally present high exposure to online gaming, increasing their risk to develop IGD (Kuss & Griffiths, 2012; Perron & Duggan, 2015). Of note is that the earlier an addictive behaviour (such as IGD) develops, the greater the likelihood it will continue (Adams et al., 2018; Ko, 2014). Studies have started to substantiate the association between early initiation and addictive features in online-based activities (Beard, Haas, Wickham, & Stavropoulos, 2017; Chang, Chiu, Lee, et al., 2014; Tsitsika et al., 2014) and consolidation of addictive behaviours during early adulthood has been associated with treatment resistance and negative outcomes (Adams et al., 2018). Despite increasing research into IGD, there appears to be a dearth of studies emphasizing IGD behaviours during this time, motivating the present work to focus on young adult MMO players.

### 1.3. Gaming genre: MMOs

Massively Multiplayer Online games (MMOs) are characterised by interactive play in large online game universes, including initiating and maintaining virtual relationships with co-players, and targets various gaming motivations, such as entertainment, task achievement, game progression, mood modification, and/or real-time, in-game socialisation (Stavropoulos et al., 2017a). Previous research by Yee (2006) has suggested five major factors reflecting MMO gaming motivations. These involve the: (i) desire of interaction with other users ('relationship' factor); (ii) tendency to objectify and manipulate other gamers for personal interest or just enjoyment ('manipulation' factor); (iii) enjoyment of substituting real life and real identity with imaginary ones ('immersion' factor); (iv) tendency to game to escape from real life distress ('escapism' factor) and; (v) desire of in-game achievements and establishment ('achievement' factor).

These processes require commitment and demand significant

amounts of time particularly from MMO players, as these enable the creation and development of online identities/avatars, and may also advance gamers' loneliness and real life social withdrawal (Anderson et al., 2017; Kuss, Louws, & Wiers, 2012; Sioni, Burleson, & Bekerian, 2017). Research suggests that MMO gamers play more often and longer than any other game sub-genre and are at higher risk for excessive gaming (Stetina, Kothgassner, Lehenbauer, & Kryspin-Exner, 2011). Overall, the literature suggests that MMO players often identify with their avatars (a virtual representation of the player within the MMO environment) which allows for: (a) escape from reality by reinforcing virtual world immersion, (b) compensation for perceived shortcomings in real life (e.g., an overweight individual creating an avatar that is physically fit), (c) competitiveness, and (d) satisfaction (Bessière, Seay, & Kiesler, 2007; Pringle, 2015; Van Looy, Courtois, De Vocht, & De Marez, 2012). These likely contribute to compromised social and educational/occupational adaptation when used to excess (Kaptis, King, Delfabbro, & Gradisar, 2016; Kuss et al., 2012; Kuss & Griffiths, 2012). The endless possibilities that the game environment provides, including the limitlessness of character development, adds to the potentially addictive nature of MMOs (Schimmenti, Infanti, Badoud, Laloyaux, & Billieux, 2017).

Similarly, it has been found that higher in-game satisfaction may reinforce psychological dependency on MMO games, especially when combined with real world discrepancies (Liu & Peng, 2009). Nevertheless, some research has differentiated high gaming engagement from gaming addiction (Griffiths, 2010a; Lehenbauer-Baum & Fohringer, 2015). More specifically, the latter appear to demonstrate longer playing time, higher immersive tendencies, and lower quality of real life in general (Lehenbauer-Baum & Fohringer, 2015). Therefore, caution is warranted when describing varying excessive MMO gaming patterns (Charlton & Danforth, 2007).

### 1.4. Hikikomori: society's hidden youth

'Hikikomori' (literally translated as 'pulling inward and being confined') appears as significant, relatively understudied factor associated with IGD behaviours (Stip, Thibault, Beauchamp-Chatel, & Kisely, 2016; Uchida & Norasakkunkit, 2015). In behavioural terms, Hikikomori comprises three to six months or more of self-imposed real life home isolation, characterised by the avoidance of social and family relationships (while online relationships may exist), and occupational and/or educational disengagement (Tajan, 2015; Teo, Stuffelbam, Saha, Fetters, Tatenos, Kanba, & Kato, 2015), and has been associated with loneliness, social deficits, and other psychopathology (Stip et al., 2016; Uchida & Norasakkunkit, 2015). Hikikomori onset is typically signified by adolescent school refusal, progressing to full real life withdrawal in young adulthood (Teo & Gaw, 2010). Presumably, mental health sensitivity inherent in the transitional nature of young adulthood may reinforce Hikikomori manifestations, compromising related formative developmental tasks (i.e., emotional maturity, independence, adaptation and identity formation; Arnett, 2000, 2007), and the earlier the onset of Hikikomori, the greater the risk of developmental disruption (Arnett, 2000; Kato, Kanba, & Teo, 2018).

### 1.5. Hikikomori and IGD

Hikikomori has been considered as a passive rebellion against family and/or broader social/cultural values and expectations (despite such individuals still living in the parental home), where extreme real life isolation is viewed as protective against the outside world (Yong & Kaneko, 2016). Consequently, those with Hikikomori (compared to those without) are more likely to utilise the virtual environment to escape, which may exacerbate real-life deficits (Stip et al., 2016; Uchida & Norasakkunkit, 2015). The virtual world is appealing, increasingly accessible, and can be used excessively by those with Hikikomori over their offline reality (Stip et al., 2016; Suwa & Suzuki, 2013; Wong et al.,

2015). This corresponds with the Compensatory Internet Use (CIU) model, which suggests that online gaming motivated by mood modification and escapism increases IGD risk (Kardefelt-Winther, 2014; Stavropoulos, Gomez, et al., 2017a). Accordingly, identifying potential moderators of the association between Hikikomori and IGD symptoms among MMO players appears important to better understand both phenomena.

#### 1.6. Hikikomori and IGD: the moderating role of game playing time

MMOs are endless games by design (i.e., they allow for accessing high-end gaming content upon reaching the final levels; Yee, 2014). Consequently, significant proportions of MMO gamers have been shown to exceed 8 h per gaming session (Ng & Wiemer-Hastings, 2005), to play more frequently at the expense of other activities, which can result in offline social and occupational problems (Kuss et al., 2012; Schimmenti et al., 2017). Though time spent gaming does not serve as a proxy for problematic use young adult MMO players who play for longer periods of time appear to be at higher risk of developing IGD. Relatedly, IGD is also associated with a number of individual factors, particularly for users who play to compensate for needs that cannot be met in the offline world (i.e., social skill deficits, poor self-esteem, self-expression and role-fulfilment; Anderson et al., 2017; Beard & Wickham, 2016; King & Delfabbro, 2014; Mills, Milyavskaya, Heath, & Derevensky, 2017; Stavropoulos, Gomez, et al., 2017a). It is thought that this may extend to Hikikomori behaviours, as players may meet social connected needs through the game, while contributing to IGD. Considering both time spent playing and risk factors, shorter game-playing time may buffer IGD behaviours of MMO gamers presenting with Hikikomori symptoms.

#### 1.7. Hikikomori and IGD: the moderating role of living with parents

In addition to game-playing time, the IGD risk of MMO gamers presenting with Hikikomori may be moderated by their domestic living conditions. Those with Hikikomori symptoms tend to live with at least one parent, where an over-dependency on parents to meet their basic needs may develop (i.e., to provide food, shelter, and financial stability; Wong et al., 2015). This could be more easily accommodated in societies where families are more likely to be financially capable of supporting young people to remain housebound for longer (Wong et al., 2015). Of note is that young adults who continue living with their parents have previously been found to have poorer parent-child relationships and lower overall psychological adaptation (Dubas & Petersen, 1996). Additional evidence suggests that in homes where there is a lack of parent-child verbal and emotional communication can create an environment where Hikikomori-associated distress continues due to being ignored, while concurrently not seeking support (Suwa, Suzuki, Hara, Watanabe, & Takahashi, 2003). Emotionally repressed home environments, general family dysfunction, and poor parental attachments have been consistently associated with both Hikikomori behaviours and excessive IU (Anderson et al., 2017; Chan & Lo, 2016). Therefore, living with parents may be a shared risk factor as it can enable the reinforcement of Hikikomori behaviours (Bowker, 2016). This can further limit opportunities to create positive interpersonal connections, healthy communication skills, self-exploration, and expression (Wong et al., 2015). Instead of promoting autonomy with a clear transition to adulthood, a prolonged, artificial adolescence can be created, interrupting and even halting normative psychosocial development (Arnett, 2000, 2007; Murphy-Shigematsu, 2014; Sachiko, 2015), which has been linked to the development of internet addiction and associated psychopathology in clinical samples (Kuss & Griffiths, 2015; Kuss & Pontes, 2018). Under these conditions, it may be assumed that seeking meaningful connections elsewhere, such as in online games (for MMO gamers), could be reinforced and strengthened. Evidently, the gaming world may be viewed as the ideal compensatory

environment for individuals presenting with Hikikomori (Sachiko, 2015). Therefore, it is expected that the IGD risk of MMO gamers presenting with Hikikomori symptoms (during emergent adulthood) could be reinforced by living with their parents. However, cross-cultural differences should also be factored into the IGD-Hikikomori relationship (Orford et al., 2013).

#### 1.8. Cultural context: Australia and the United States

There is evidence suggesting that there are cultural differences regarding the prevalence, incidence and experience of addictions, which may potentially exacerbate and/or buffer specific addiction related risk and protective factors, such as Hikikomori behaviours (Gjersing, Caplehorn, & Clausen, 2010; Landrine & Klonoff, 1992; Stavropoulos et al., 2018; Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000). Consequently, potential differences in the risk of Hikikomori and IGD are investigated between gamers in Australia and the United States (US) in the present study. This choice was based on several arguments. First, a significant proportion of IGD research refers to US and, more recently, Australian populations (Kaptis et al., 2016; Petry et al., 2014). Second, the US and Australia have been classified within the top 15 online game markets globally (the US is number two and Australia is number 14; Global Games Market Report, 2016). Third, IGD treatment programs have emerged in both US and Australia (i.e., “reSTART” in the U.S. and the “Network for Internet Investigation and Research” in Australia; Stavropoulos et al., 2018). Finally, irrespective of their broader cultural similarities (e.g., language and social structure), significant cultural differences among the two countries have been assumed in relation to “vertical” and “horizontal” individualism that could vary the risk of specific psychopathological presentations (Clemens, Begum, Harper, Whitty, & Scuffham, 2014; Singelis, Triandis, Bhawuk, & Gelfand, 1995; Stavropoulos et al., 2018; Stavropoulos, Alexandraki, & Motti-Stefanidi, 2013). In brief, individualism describes an association between the individual and his/her cultural group, where individual interests and goals are prioritized, while collectivism places higher value on group interests (Lee & Wohn, 2012).

In this context, “vertical” individualism refers to a subtype of individualism where there is concurrent inequality among individuals (i.e., inequality in opportunities and social welfare). On the other side “horizontal” individualism involves the notion of equality (Lee & Wohn, 2012; Singelis et al., 1995). Social structures and state policies in Australia reflect more “horizontal” features compared to the more “vertical” features of the US (Lee & Wohn, 2012; Singelis et al., 1995; Stavropoulos et al., 2018). Following this line of thought, horizontal and vertical individualism tendencies have been associated with different gaming expectations and goals, with more vertically identified gamers being driven by ranking and achievement, which has been assumed to increase the risk of IGD behaviours (Lee & Wohn, 2012; Stavropoulos et al., 2018; Stetina et al., 2011). Furthermore, within a more vertically individualistic social context like the US, where higher disconnection and independence between family members exist even when they may reside together, the hypothetical exacerbating effect of living with parents on the IGD risk of players presenting with Hikikomori behaviours could be minimized. Therefore, cultural differences could affect how Hikikomori symptoms may predict IGD behaviours, potentially further differentiating the risk of those living with their families (Pontes, Stavropoulos, & Griffiths, 2017; Anderson et al., 2017).

#### 1.9. The present study

The present study embraced a dimensional conceptualization of IGD behaviours (from minimum to maximum; Pontes & Griffiths, 2015) to explore how the gamers' levels of Hikikomori symptoms may act as a potential IGD risk factor and how (if at all) this association varies depending on game-playing time and living with parents or not, and



whether these associations differ among Australian and US populations. To address these aims, the present study used a cross-cultural and cross-sectional design to examine two online samples of Australian and US-North American young adult (18–29 years) MMO players. The following hypotheses were formulated:

**H<sub>1</sub> :** MMO gamers with higher Hikikomori scores will have higher IGD scores.

Hikikomori is associated with excessive gaming-related IU, increasing IGD risk (Stip et al., 2016). Internet engagement to compensate for real-life deficits increases the risk of negative outcomes, such as IGD behaviours (Kuss et al., 2012; Kuss et al., 2017). This association is not envisaged to be significantly different between Australian and US-North American gamers.

**H<sub>2</sub> :** Playing time is expected to moderate the risk of Hikikomori on IGD, such that individuals with higher playing time will have a stronger association between Hikikomori and IGD.

Types of online games such as MMOs are specifically designed to require significant amount of time and investment at the expense of other activities (Yee, 2014). The more time individuals spend gaming, the more they are expected experience real life social withdrawal/Hikikomori, and the higher the risk of IGD irrespective of the country of residence of the gamers (Kuss et al., 2012).

**H<sub>3</sub> :** Players who experience Hikikomori symptoms will be at higher risk of developing IGD when living with their parents.

Living in the parental home provides an environment that may enable and reinforce Hikikomori behaviours, while reducing the desire and perceived need for treatment (Bowker, 2016; Sachiko, 2015). Unmet needs could then be sought in the game world, reinforcing IGD risk and avoidance of real-world interactions (Stip et al., 2016). Cross-cultural differences are expected to be found, with higher “vertical” individualistic tendencies in the US could presenting with a differential IGD-Hikikomori relationship when living with their parents compared to their Australian counterparts (Stavropoulos et al., 2018).

## 2. Method

### 2.1. Participants

The sample comprised 153 Australian ( $M_{age} = 23.38$  years,  $SD = 3.50$ ,  $Min_{age} = 18$  years,  $Max_{age} = 29$  years, Males = 116, 75.9%) and 458 American<sup>1</sup> ( $M_{age} = 25.25$  years,  $SD = 2.76$ ,  $Min_{age} = 18$  years,  $Max_{age} = 29$  years, Males = 265, 57.98%) emerging adult players of MMOs (18–29 years; Arnett, Žukauskienė, & Sugimura, 2014). A complete summary of their sociodemographic and online use characteristics is provided in Table 1. The estimated maximum sampling error regarding the 153 Australian gamers was 7.92% ( $z = 1.96$ , confidence level 95%) while for the 458 US gamers was 4.58% ( $z = 1.96$ , confidence level 95%) and for the 611 participants of the combined Australian and US sample was 3.97% ( $z = 1.96$ , confidence level 95%).

In regard to the Australian data, missing values ranged between 2% and 6% across all items and were determined to have been missing completely at random using Little's missing completely at random procedure (Little's MCAR test  $X^2 = 743.042$ ,  $p > .05$ ; Little, 1988). Participant responses from the US sample were included for independent participants who reported data on any of the measures of interest (i.e., accessed and filled out at least one questionnaire). The responses on the 458 valid US samples for missing values ranged lower, between 0.2% and 4.8%, across all items, which were also confirmed to have been missing completely at random (Little's MCAR test  $X^2 = 8.35$ ,  $DF = 7$ ,  $p > .05$ ; Little, 1988). Given that missing values were not systematic in both samples, and not to reduce sample power (due to listwise deletion), maximum likelihood imputation was applied five times based on the available variables and in line with relevant

literature recommendations (Newman, 2003).

### 2.2. Materials

The mean daily game playing time (number of hours per day) and “living or not with parents” (0 = No, 1 = Yes) information were addressed within the demographic section of the battery used.

#### 2.2.1. Internet Gaming Disorder Scale – short form (IGDS-SF9)

The IGDS-SF9 was used to assess self-reported symptoms of IGD (Pontes & Griffiths, 2015), and comprises nine items directly modelled on DSM-5 IGD criteria (APA, 2013). Items are rated on a five-point Likert scale (1 = ‘Never’ to 5 = ‘Very often’) with total scores ranging from 9 to 45. Higher scores indicate higher self-reported symptoms of IGD. Recent literature shows the IGDS-SF9 has good psychometric properties, including high criterion-related validity, concurrent validity, and internal reliability (Pontes & Griffiths, 2015). The present study produced acceptable reliability results for both the Australian and the US samples examined (Cronbach's alpha<sub>Australia</sub> = 0.88; Cronbach's alpha<sub>U.S.</sub> = 0.90).

#### 2.2.2. Hikikomori Social Withdrawal Scale (HSWS) in real life

The HSWS was developed based on criteria used in the Hikikomori Assessment Interview by Teo, Fetter, Stufflebam, Taten, Balhara, Choi, Kanba, Mathews, & Kato, 2015 to enable the dimensional assessment of participants' self-reported Hikikomori symptoms. The HSWS comprises four items relating to real life social withdrawal behaviour and distress, which were assessed here with the addition of a five-point Likert scale (1 = Disagree to 5 = Agree) on the Hikikomori Assessment Interview items. The total scores range from 4 to 20, with higher scores indicating higher symptoms of Hikikomori. A fifth item referring to coexisting mental illness requiring a ‘yes/no’ response was also included. The internal reliability of the HSWS for the present study was acceptable for both the Australian and the US samples (Cronbach's alpha<sub>Australia</sub> = 0.84; Cronbach's alpha<sub>U.S.</sub> = 0.82).

### 2.3. Procedure

The present study was drawn from a larger study on risks and resilience factors for IGD, and was approved by the Human Research Ethics Committee of Federation University and the ethics committee (IRB) at Palo Alto University. Eligible individuals included Australian and US permanent residents or citizens, young adults (18–29 years), gamers of MMOs. Participants were invited to register with the study via a SurveyMonkey and/or an Amazon Mechanical Turk (AMT) link that were advertised across online gaming websites and forums (www.ausgamers.au). SurveyMonkey and AMT are appropriate and reliable tools to collect participant responses for psychological research (Chandler & Shapiro, 2016). Research has shown that online data collection and paper-and-pencil methods are generally equivalent (Monster & Pettit, 2002; Weigold, Weigold, & Russell, 2013). Furthermore, online data collection was preferred here based on recommendations that it is cost-effective, and facilitates accessibility to hard-to-reach groups, such as the MMO gamers recruited for the present study (Griffiths, 2010b).

Participants of both national samples were initially directed to the Plain Language Information Statement (PLIS) when they clicked on the study link. The PLIS explicitly indicated that participation was voluntary, that respondents were free to withdraw from the study at any time, that if at any point respondents chose to discontinue participation they were not required to provide any explanation, and there was no penalty associated with withdrawing. Respondents were only able to complete and submit the questionnaire once consent to participate in the study was provided, and they indicated that they understood the nature of the research being conducted.

**Table 1**  
Sociodemographic characteristics of participants.

Sociodemographic variables		Australian total (n = 153)	US total <sup>1</sup> (n = 458)
Gender	Male	116 (75.9%)	266 (58.1%)
	Female	37 (24.2%)	184 (40.2%)
	Transgender/Genderqueer/Other	–	8 (1.7%)
Employment status	Unemployed	17 (11.1%)	41 (10.5%)
	Temporary leave	2 (1.3%)	–
	Student	57 (37.3%)	48 (10.3%)
	Casual employment	27 (17.6%)	–
	Part-time employment	22 (14.4%)	87 (18.8%)
	Full-time employment	56 (36.6%)	274 (59.8%)
Living with	Family of origin (two parents and siblings if any)	47 (30.7%)	85 (18.6%)
	Mother and siblings if any (parents divorced/separated)	8 (5.2%)	26 (5.7%)
	Mother and siblings if any (father passed away)	3 (2.3%)	11 (2.4%)
	Father and siblings if any (parents divorced/separated)	1 (0.6%)	4 (0.9%)
	With partner	44 (28.3%)	120 (26.3%)
	With partner and siblings	6 (4%)	5 (1.1%)
	Alone	6 (3.6%)	69 (15.1%)
	With friends	20 (13.1%)	48 (10.5%)
	Shared accommodation	19 (12.2%)	–
	Transient accommodation	–	4 (0.9%)
	Did not respond	–	86 (18.6%)

Note: The difference considering the living condition responses across the two samples was assessed using a  $\chi^2$  test that was significant ( $\chi^2 = 37.95$ ,  $p = .001$ ), indicating significant differences between the two countries.

## 2.4. Analyses

To assess the association between Hikikomori symptoms and IGD behaviours (H1), two hierarchical linear regression models were conducted (one for each of the two countries). Based on the relevant literature, and to control for the possible confounding effects of gender (dummy coded 0 = females, 1 = males) and age on IGD behaviours (Anderson et al., 2017; Kuss, Griffiths, Karila, & Billieux, 2014), these were inserted separately as IGD predictors/confounders at step one. Hikikomori severity was then inserted as an IGD predictor at the second step of the two models examined. To assess the potential moderating/differentiating effect of the country of residence of the gamer (Australia or US) on the association between Hikikomori symptoms and IGD behaviours, an additional moderation analysis was conducted on the combined sample using the Process macro (Hayes, 2013) on IBM Corp. SPSS 21. Hikikomori symptoms were used as the independent variable, and country of origin as the moderator (dummy coded 0 = Australia, 1 = US), with IGD as the outcome variable (Hayes, 2013). Age and gender were also inserted into the model as covariates to address possible confounding effects (Hayes, 2013). Bootstrapping at the minimum recommended level of 1000 resamples was additionally conducted (Bland & Altman, 2015).

To assess the potentially exacerbating (risk) effect of game playing time on the IGD risk of gamers who present with higher Hikikomori behaviours (H2), a moderation analysis was conducted twice (one for each of the two countries) using the Process macro (Hayes, 2013) on SPSS 21. Hikikomori symptoms were used as the independent variable, playing time as moderator, and IGD as outcome variable (Hayes, 2013). Finally, to assess whether the moderating effect of game playing time on the association between Hikikomori and IGD behaviours differed between countries, a moderated moderation model was conducted using the Process macro (Hayes, 2013). This model only differed from the ones examined for the two countries on the basis of using the combined sample and inserting the country of origin (dummy coded 0 = Australia, 1 = US) as a moderator of the effect of game playing time on the association between Hikikomori and IGD behaviours (such that a three way interaction between Hikikomori, game playing time and country on IGD behaviours was examined).

Additionally, to assess the moderating effect of living with parent/parents (dummy coded 0 = living with parents, 1 = not living with parents) on the IGD risk of those gamers who presented with higher

Hikikomori behaviours (H3), a second moderation analysis was conducted twice (one for each of the two countries separately and one combined). Hikikomori behaviours were used as the independent variable, living with parent/parents as bivariate moderator, and IGD as outcome variable (Hayes, 2013). Similarly, to assess whether the moderating effect of living with parents on the association between Hikikomori and IGD behaviours differed between countries, a moderated moderation model was conducted using the Process macro (Hayes, 2013). This model used the combined sample and inserted the country of origin (dummy coded 0 = Australia, 1 = US) as a moderator of the moderating effect of living with parents on the association between Hikikomori and IGD behaviours (such that a three way interaction between Hikikomori, living with parents and country on IGD behaviours was examined-no centering was applied).

## 3. Results

Prior to addressing the study hypotheses, IGD and Hikikomori prevalence rates – considering US and Australian samples in relation to gender, age, and living or not with parents – were calculated based on literature recommendations (both more specific and more sensitive cut off points were used in the case of IGD; Gomez, Stavropoulos, Beard, & Pontes, 2018; Pontes & Griffiths, 2016; Teo, Fletters et al. 2015). The Australian samples were significantly more likely than the US sample be residing with their parents (see Table 2).

Considering H1, the results of the Australian data analyses indicated that the slope of the regression line regarding the IGD effect of Hikikomori symptoms was statistically significant ( $F_{\text{change}}(1, 167) = 37.780$ ,  $p = .001$ ). More specifically, 17.5% of the variance of IGD scores was explained by the addition of Hikikomori in the second step of the model ( $R^2 = 0.175$ ). Accordingly, for each point of increase on the 5-point Hikikomori scale, IGD scores increased by 0.85 points ( $b = 0.85$ ,  $t = 6.15$ ,  $p = .001$ ). It should also be noted that the full model (two-steps predictors, gender, age and Hikikomori) explained approximately 23% of the variance in IGD scores ( $R^2 = 0.225$ ,  $F_{(3, 167)} = 16.182$ ,  $p = .001$ ).

The US results were similar ( $F_{\text{change}}(1, 454) = 160.71$ ,  $p = .001$ ) with 26% of the variance in IGD scores being explained by Hikikomori ( $R^2 = 0.26$ ). More specifically, for each point of increase in Hikikomori, IGD scores increased by 0.89 points ( $b = 0.89$ ,  $t = 13.09$ ,  $p = .001$ ). The full US data model (controlling for the effects of age and gender)

**Table 2**

IGD, Hikikomori prevalence rates and scores in relation to demographics for USA and Australian samples.

	For both countries	Australian total	Australia		US		
			Female	Male	US total	Female	Male
IGDS9-SF: Total score	20.16 ± 7.92	18.86 ± 8.21	20.59 ± 10.56	18.26 ± 7.23	20.62 ± 7.78	19.78 ± 7.69	21.26 ± 7.74
IGDS9-SF: Disordered (≥36 <sub>more specific threshold</sub> )	Yes = 4.4%	Yes = 5.2%	Yes = 16.7%	Yes = 1.7%	Yes = 4.1%	Yes = 2.3%	Yes = 5.2%
	No = 95.6%	No = 94.8%	No = 83.3%	No = 98.3%	No = 95.9%	No = 97.7%	No = 94.8%
IGDS9-SF: Disordered (≥25 <sub>more sensitive threshold</sub> )	Yes = 29%	Yes = 17.6%	Yes = 22.2%	Yes = 15.7%	Yes = 31.4%	Yes = 30.7%	Yes = 35.3%
	No = 71%	No = 82.4%	No = 77.8%	No = 84.3%	No = 63.8%	No = 69.3%	No = 64.7%
HSWS: total score	9.68 ± 4.34	8.46 ± 4.16	10.11 ± 5.53	7.92 ± 3.54	10.11 ± 4.33	9.87 ± 4.56	10.20 ± 4.11
HSWS: disordered (=20)	Yes = 1.8%	Yes = 3.3%	Yes = 13.9%	Yes = 0%	Yes = 1.4%	Yes = 2.3%	Yes = 0.8%
	No = 94.6%	No = 96.7%	No = 86.1%	No = 100%	No = 98.6%	No = 97.7%	No = 99.2%
Living with parents (In any form)	Yes = 29.6%	Yes = 38.8%	Yes = 83.3%	Yes = 56.5%	Yes = 27.5%	Yes = 17.9%	Yes = 18.8%
	No = 70.4%	No = 62.2%	No = 16.7%	No = 43.5%	No = 72.5%	No = 82.1%	No = 81.2%

Note: IGDS9-SF = Internet Gaming Disorder Scale – Short Form 9; HSWS = Hikikomori Social Withdrawal Scale. The potential prevalence rates of gaming disorder and Hikikomori, as defined by scoring above the recommended cut-off points (IGDS9-SF: 5 criteria addressed with 5 equals 25; Gomez et al., 2018; IGDS9-SF ≥ 36, Pontes & Griffiths, 2016; HSWS: Four criteria met and absence of comorbid psychopathology; Teo et al., 2015) were reported for both samples of USA and Australian gamers. This effort is in line with the recommendation of the APA Substance-Related Disorders Work Group for more research on the gaming disorder prevalence (Stavropoulos et al., 2018). In contrast, with past studies, were methodological differences may have confounded results, this study used the same IGD and Hikikomori assessment tools for both Australian and USA samples.

explained 27.0% of the variance in IGD scores ( $R^2 = 0.27$ ,  $F_{(3, 454)} = 56.09$ ,  $p = .001$ ).

To assess the potentially moderating effect of country on the association between Hikikomori and IGD behaviours a moderation analysis adopting the methodology recommended by Hayes (2013) was conducted for the combined Australian and US data, controlling concurrently for the effects of age and gender. Bootstrapping at 1000 resamples was applied to increase the confidence in the results. The following model was estimated:

$$\text{IGD Score} = a + b_1 \text{Hikikomori Scores} + b_2 \text{country} + b_3 [\text{Hikikomori Scores} \times \text{country}] + b_4 \text{age} + b_5 \text{gender}$$

Findings indicated that both the effect of country [ $b_2 = 0.68$ ,  $t = 0.44$ ,  $p = .659$ ,  $\text{LLCI} = -2.36$  –  $\text{ULCI} = 3.72$ ] and the effect of the interplay between Hikikomori behaviours and country [ $b_3 = 0.03$ ,  $t = 0.20$ ,  $p = .839$ ,  $\text{LLCI} = -0.273$  –  $\text{ULCI} = 0.337$ ] on IGD scores were non-significant, with the latter explaining < 0.01% of the IGD score variance ( $R^2 = 0.0001$ ). To address H2, a moderation analysis was conducted twice (one for the Australian and one for the US data). Age and gender effects were controlled and bootstrapping at the minimum recommended 1000 resamples was conducted. The following equation was estimated:

$$\text{IGD Score} = a + b_1 \text{Hikikomori Scores} + b_2 \text{game playing time} + b_3 [\text{Hikikomori Scores} \times \text{game playing time}] + b_4 \text{age} + b_5 \text{gender}$$

The overall model was significant for the Australian sample ( $F_{(5, 147)} = 10.88$ ,  $p = .001$ ). More specifically, 27.03% of the variance in IGD scores was explained by Hikikomori scores, daily playing time, and their interaction ( $R^2 = 0.2703$ ). Furthermore, the model yielded a significant interaction between Hikikomori and playing time on the severity of IGD scores [ $b_3 = 0.13$ ,  $t = 2.55$ ,  $p = .012$ ,  $\text{LLCI} = 0.03$  –  $\text{ULCI} = 0.23$ ]. As playing time increased by 1 h, the coefficient for the Hikikomori effect on IGD increased by 0.13 (see Table 2 for the full model summary).

The US model was also significant ( $F_{(5, 453)} = 29.08$ ,  $p = .001$ ), with 28.22% of the variance in IGD scores explained by Hikikomori scores, daily playing time, and their interaction ( $R^2 = 0.2822$ ). Moreover, Hikikomori and daily playing time had a significant interaction [ $b_3 = 0.08$ ,  $t = 2.70$ ,  $p = .007$ ,  $\text{LLCI} = -0.53$  –  $\text{ULCI} = -0.02$ ]. As daily playing time increased by 1 h, the coefficient for the Hikikomori effect on IGD increased by 0.08 (see Table 2 for full model summary).

To assess whether the moderating effect of game playing time of the

association between Hikikomori symptoms and IGD behaviours (H2) was significantly moderated by country, a *moderated moderation* analysis was calculated, controlling for gender and age and based on bootstrapping on the minimum recommended 1000 resamples using the combined Australian and US samples. The following equation was estimated:

$$\begin{aligned} \text{IGD Scores} = & a + b_1 \text{Hikikomori Scores} + b_2 \text{game playing time} \\ & + b_3 \text{Country} + b_4 [\text{Hikikomori Scores} \\ & \times \text{Game playing time}] + b_5 [\text{Hikikomori} \times \text{Country}] \\ & + b_6 [\text{Game Playing Time} \times \text{Country}] \\ & + b_7 [\text{Hikikomori} \times \text{Country} \times \text{Game Playing Time}] \\ & + b_8 \text{Gender} + b_9 \text{Age} \end{aligned}$$

While the overall model was significant ( $F_{(7, 603)} = 22.68$ ,  $p = .001$ ), with 28.2% of the variance in IGD scores ( $R^2 = 0.282$ ) explained by Hikikomori scores, game playing time, country and their interactions, the three-way interaction between Hikikomori scores, country, and game playing time on IGD was non-significant [ $b_7 = -0.05$ ,  $t = 0.86$ ,  $p = .392$ ,  $\text{LLCI} = -0.16$  –  $\text{ULCI} = -0.07$ ].

To address H3, a moderation analysis was conducted twice (one for the Australian and one for the US data). Age and gender effects were controlled and bootstrapping at the minimum recommended 1000 resamples was applied. The following equation was estimated:

$$\begin{aligned} \text{IGD Scores} = & a + b_1 \text{Hikikomori Scores} + b_2 \text{Living with Parents} \\ & + b_3 [\text{Hikikomori Scores} \times \text{Living with Parents}] + b_4 \text{age} \\ & + b_5 \text{gender} \end{aligned}$$

For the Australian data, the overall model was significant ( $F_{(5, 147)} = 9.96$ ,  $p = .001$ ). More specifically, 25.3% of the variance in IGD scores was explained by Hikikomori scores, living with parents, and their interaction ( $R^2 = 0.253$ ). Furthermore, Hikikomori and living with parents appeared to interact regarding the severity of IGD scores [ $b_3 = 0.76$ ,  $t = 2.51$ ,  $p = .013$ ,  $\text{LLCI} = 0.162$  –  $\text{ULCI} = 1.365$ ]. More specifically, for those living with their parents, the coefficient for the Hikikomori effect on IGD increased to 0.76 (see Table 3 for the full model summary). The US model was also significant ( $F_{(5, 453)} = 29.97$ ,  $p = .001$ ) with 26.72% of the variance in IGD scores explained by Hikikomori scores, living with parents, and their interaction ( $R^2 = 0.2672$ ). However, Hikikomori and living with parents did not have a significant interaction on IGD behaviours [ $b_3 = 0.17$ ,  $t = 0.82$ ,  $p = .416$ ,  $\text{LLCI} = -0.23$  –  $\text{ULCI} = -0.57$ ]. (See Table 4.)

To assess and confirm the moderating effect of living with parents

**Table 3**

Estimating IGD behaviours from Hikikomori symptoms, game playing time per day (during weekdays) and their interaction.

Australian	<i>b</i>	SE	<i>t</i>	<i>p</i>	LLCI	UCLI
$\alpha$ : constant/intercept	24.19	4.54	5.33	0.000	15.22	33.17
<i>b1</i> : Hikikomori ( <i>F</i> )	0.39	0.21	1.84	0.049	0.03	0.81
<i>b2</i> : Playing Time ( <i>M</i> )	−0.72	0.51	−1.43	0.154	−1.72	0.28
<i>b3</i> : Interaction of Hikikomori and playing time on IGD	0.13	0.05	2.60	0.012	0.03	0.23
<i>b4</i> : Age	−0.41	0.16	−2.53	0.012	−0.74	−0.09
<i>b5</i> : Gender	−0.33	1.41	−0.23	0.816	−3.13	2.47
United States	<i>B</i>	<i>SE</i>	<i>T</i>	<i>p</i>	<i>LLCI</i>	<i>UCLI</i>
$\alpha$ : constant/intercept	19.86	3.54	5.61	0.000	12.90	26.82
<i>b1</i> : Hikikomori ( <i>F</i> )	0.60	0.12	4.94	0.000	0.36	0.84
<i>b2</i> : Playing Time ( <i>M</i> )	−0.76	0.40	−1.90	0.058	−1.55	0.03
<i>b3</i> : Interaction of Hikikomori and playing time on IGD	0.09	0.03	2.70	0.007	0.02	0.15
<i>b4</i> : Age	−0.27	0.13	−2.13	0.033	−0.53	−0.02
<i>b5</i> : Gender	1.62	0.69	2.33	0.020	0.25	2.98

Note. *b* = estimated value of unstandardized regression coefficient; SE = standard error; *t* = *t*-test statistic; *p* = probability; LLCI = lower level confidence interval; UCLI = upper level confidence interval.

**Table 4**

Estimating IGD Behaviours from Hikikomori Symptoms, Living with Parents and their Interaction.

Australian	<i>B</i>	SE	<i>T</i>	<i>p</i>	LLCI	UCLI
$\alpha$ : constant/intercept	24.70	4.71	5.25	0.000	15.40	34.02
<i>b1</i> : Hikikomori ( <i>F</i> )	0.58	0.18	3.30	0.001	0.23	0.93
<i>b2</i> : living with parents ( <i>M</i> )	−5.97	2.83	−2.11	0.036	−11.55	−0.38
<i>b3</i> : interaction of Hikikomori and living with parents on IGD	0.76	0.30	2.51	0.013	0.16	1.37
<i>b4</i> : age	−0.43	0.17	−2.51	0.013	−0.77	−0.09
<i>b5</i> : gender	−0.10	1.46	−0.68	0.497	−3.89	1.89
US	<i>B</i>	<i>SE</i>	<i>T</i>	<i>p</i>	<i>LLCI</i>	<i>UCLI</i>
$\alpha$ : constant/intercept	17.18	3.48	4.93	0.000	10.33	24.02
<i>b1</i> : Hikikomori ( <i>F</i> )	0.75	0.19	4.04	0.000	0.39	1.11
<i>b2</i> : living with parents ( <i>M</i> )	−2.92	2.43	−1.20	0.229	−7.71	1.86
<i>b3</i> : interaction of Hikikomori and living with parents on IGD	0.17	0.20	0.82	0.416	−0.24	0.57
<i>b4</i> : age	−0.16	0.12	−1.25	0.211	−0.40	−0.09
<i>b5</i> : gender	1.36	0.67	2.05	0.042	0.05	2.68

Note. *b* = estimated value of unstandardized regression coefficient; SE = standard error; *t* = *t*-test statistic; *p* = probability; LLCI = lower level confidence interval; UCLI = upper level confidence interval.

IGD-Hikikomori association, (H2) a moderated moderation analysis was calculated. Gender and age were entered into the model as covariates. The model was conducted with bootstrapping on the minimum recommended 1000 resamples using the combined Australian and US samples. The following equation was estimated:

$$\begin{aligned} \text{IGD Scores} = & a + b_1 \text{Hikikomori Scores} + b_2 \text{Living with Parents} \\ & + b_3 \text{Country} + b_4 [\text{Hikikomori Scores} \\ & \times \text{Living with Parents}] + b_5 [\text{Hikikomori} \times \text{Country}] \\ & + b_6 [\text{Living with Parents} \times \text{Country}] \\ & + b_7 [\text{Hikikomori} \times \text{Country} \times \text{Living with Parents}] \\ & + b_8 \text{Gender} + b_9 \text{Age} \end{aligned}$$

The overall model was significant ( $F_{(9, 560)} = 18.71, p = .001$ ), with 26.4% of the variance in IGD scores ( $R^2 = 0.264$ ) explained by Hikikomori scores, living with parents, country and their interactions. The three-way interaction between Hikikomori scores and being Australian on IGD was significant [ $b_7 = 0.71, t = 2.48, p = .014, LLCI = 0.15 - UCLI = 1.27$ ]. (See Fig. 1.)

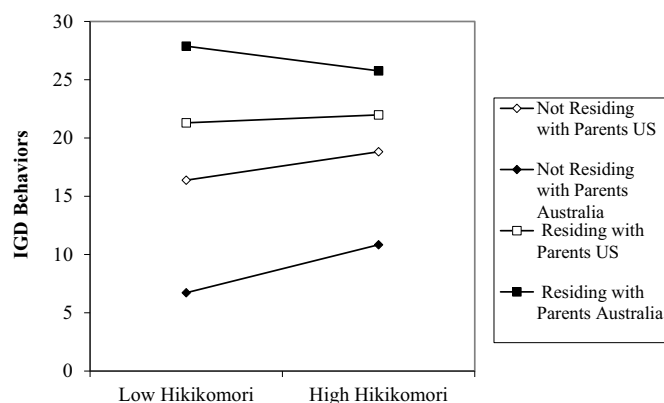


Fig. 1. The effect of the interplay of Hikikomori, living with parents and country on IGD behaviours.

#### 4. Discussion

The present study cross-culturally examined IGD behaviours in a combined online sample of Australian and US (North American) young adult MMO players. Hikikomori symptoms were preliminarily investigated as an IGD risk that could be exacerbated by daily time spent on gaming and living with parent/s. Linear regression, moderation and moderated moderation analyses confirmed that higher Hikikomori symptoms were associated with increased IGD scores. This effect did not significantly differ across countries. Furthermore, the magnitude of this association was reinforced by longer game-playing time for both populations and additionally for Australians who continued living in their parental home. Findings indicated the significance of Hikikomori manifestations in the development of IGD and the potential protective effects of reducing daily gaming time and encouraging independent living among more socially withdrawn young adult MMO Australian gamers. Furthermore, the need for considering cultural variations regarding contextual IGD risk factors was illustrated. These results could provide guidelines for more effective research, as well as intervention and prevention initiatives in this high-risk population of gamers, concurrently embracing a culturally sensitive approach.

##### 4.1. Hikikomori and IGD

Among young adult MMO players, elevated symptoms of Hikikomori were associated with higher IGD behaviours and this did not significantly vary between Australian and US gamers. This finding aligns with previous literature suggesting that by withdrawing from the world in real life, those with Hikikomori may engage in online activities to compensate for unmet emotional needs of belonging and face-to-face interpersonal connections (Stip et al., 2016; Uchida & Norasakkunkit, 2015). Studies have suggested that compensatory internet gaming could become excessive, thus precipitating and perpetuating states of psychological dependency, intertwined with IGD (Liu & Peng, 2009). Therefore, it is possible that specific alluring and potentially addictive characteristics of MMOs could be experienced as ideal for those who exhibit Hikikomori symptoms (Stavropoulos, Gomez, et al., 2017a), pushing MMO players endorsing higher Hikikomori symptoms to develop a virtual 'life' that counterbalances their face-to-face seclusion, thus moderating negative emotional states (Sachiko, 2015). This concurs with findings showing that those presenting with Hikikomori tend to favour cyber-relationships and experience higher relationship satisfaction online compared to offline activities (Chan & Lo, 2014; Stip et al., 2016). Furthermore, the present finding demonstrates that the strength of the Hikikomori-IGD association exceeds cultural differences between Australian and US samples, supported in relevant studies (Stavropoulos et al., 2018; Pontes et al., 2017).



Overall, the hypotheses correspond with the Compensatory Internet Use (CIU) model, supporting IU as a form of emotional and psychological coping that increases addictive risks (Kardefelt-Winther, 2014; Kuss et al., 2017; Yong & Kaneko, 2016). Additionally, as Hikikomori often goes unnoticed and prognosis worsens without treatment (Stip et al., 2016), the present authors suggest that the association between Hikikomori and IGD could likely strengthen over time. This finding corroborates past research (Anderson et al., 2017; Stavropoulos, Kuss, et al., 2017b) and demonstrates the need to recognise socially withdrawn young adults as being at risk of developing IGD. Further longitudinal studies are required to determine the nature of the association (bi-directional or one-way) between Hikikomori and IGD behaviours over the lifespan and across other cultures.

#### 4.2. Hikikomori and IGD: the moderating role of game playing time

Second, the hypothesis that MMO players who experienced higher Hikikomori symptoms would be at an increased IGD risk when spending more time gaming daily was supported and findings were consistent across both North American and Australian samples. More specifically, for every hour increase in game-playing time, the association between Hikikomori symptoms and IGD was reinforced in both populations. Considering young adult MMO gamers who present with more severe Hikikomori symptoms (thus tending to remain more isolated in real life for potentially higher periods of time), gaming may become their primary means of daily activity, stimulation, communication, and social connection, at the expense of offline social and occupational commitments (Suwa & Suzuki, 2013). The greater the online connection for this population (via gaming), the more likely it could be assumed that their real-life disconnection will become, elevating their risk of developing IGD.

Previous literature has also found that the more time is spent playing MMOs, and the more frequently an individual plays, the more likely negative consequences associated with IGD are experienced (Kuss et al., 2012; Sachiko, 2015) although it should be noted that some gamers can play excessively without any negative consequences (Griffiths, 2010a). Additionally, prolonged daily gaming may exacerbate IGD risk due to being in direct conflict with engagement in potential occupational and study commitments. Therefore, similar to other behavioural addictions, a reciprocal, perpetuating cycle of real life isolation and online gaming behaviours ensues, potentially at the expense of other responsibilities, that becomes intensified with more time spent playing (Griffiths, Kuss, & Pontes, 2016; Poli, 2017). Subsequently, reducing or limiting game-playing time may provide a target for IGD intervention among young adult MMO players who experience Hikikomori behaviours in Australia and the U.S.

#### 4.3. Hikikomori and IGD: the moderating role of living with parents

Finally, MMO players who experienced increased Hikikomori symptoms appeared to be at higher risk of IGD when living in the parental home in Australia and not in the US. Studies have suggested that living with parents during young adult years can suspend emotional and social development by encouraging prolonged dependency (i.e., gaining employment, emotional maturity and independence; Arnett, 2000, 2007; Kuss & Griffiths, 2015; Wong et al., 2015). Such effects could be minimized, if not completely neutralized in more vertically individualistic cultures as the US, where living in the same house with parents may not necessitate dependency due to the stronger individualistic tendencies experienced (Lee & Wohn, 2012; Singelis et al., 1995; Stavropoulos et al., 2013). Additionally, it has been shown that for socially isolated young adults who live with their parents, the parent-child relationship may be characterised by imbalanced power dynamics, lack of effective communication, and be dysfunctional and emotionally repressive. However, this was not investigated in the present study (Chan & Lo, 2016; Suwa et al., 2003).

Therefore, it could be postulated that Australian young adult gamers with Hikikomori who reside with parents might engage with gaming excessively in order to compensate for unmet emotional and attachment needs within their family environment (Krieg & Dickie, 2011; Sachiko, 2015). This hypothesis may not apply for US young adult MMO gamers due to the different (e.g., less demanding) expectations and experiences related to the emotional and attachment needs in a more vertically individualistic context (Singelis et al., 1995). Nevertheless, more thorough evaluation of family-related and cultural factors is recommended to better clarify how family and living conditions can moderate the Hikikomori-IGD association across diverse populations of gamers.

Although those who are socially isolated in real life may not always be dependent on their parents when living with them, becoming entrenched in the family system is likely to perpetuate IGD risk, especially in less vertically individualistic cultures (Bowker, 2016; Stavropoulos et al., 2018). Consequently, conducting further studies and educating and enlisting parents as an active component in IGD intervention and treatment strategies, as well as promoting competence and independence is envisaged as effective among those presenting with Hikikomori symptoms (Chan & Lo, 2016). This may be particularly relevant to less vertically individualistic cultures, where it is increasingly common for young adults to live with their parents for longer periods due to various socioeconomic factors (i.e., rising house prices and cost of living; Australian Bureau of Statistics, 2013).

#### 4.4. Limitations and implications for future research

The present study employed self-selected and self-report data with two relatively modest, national online, samples, where participants' own subjective bias and level of truthfulness is unable to be assessed (Stone, Bachrach, Jobe, Kurtzman, & Cain, 1999). Given the psychopathological nature of both IGD and Hikikomori manifestations, the use of clinical interviews would have increased the reliability of the findings and should therefore be adopted in future studies. Similarly, the cross-sectional study design provides data from a single time-point, limiting the ability to make direct causal inferences between variables (Payne & Payne, 2004). Future research should consider employing a longitudinal design to allow the potential for cause-effect relationships between Hikikomori and IGD to be examined more rigorously. Participants were also limited to Australian and US citizens and permanent residents. Consequently, specific variations of cultural characteristics were considered, imposing inevitable limitations in the generalizability of the findings and inviting further research across more diverse cultures. Consequently, it should be noted that the distribution of the living conditions reported by the participants across the two countries varied significantly, and given the association with Hikikomori behaviours, it may have confounded the results. Similar differences should be addressed in future related cross-cultural studies. Finally, it is recommended that future studies focus on the young adult population as an IGD risk population group to expand knowledge in the field, taking concurrently into consideration cultural differences in relation to the vertical and horizontal individualism-collectivism dimensions.

## 5. Conclusion

To the best of the authors' knowledge, the present study is one of the first to examine the relationship between Hikikomori and IGD, and more specifically, to investigate this relationship among the high-IGD-risk population group of young adult MMO players in Australia and the US. The present study adds to previous literature in that those with Hikikomori symptoms appear to be at risk of developing IGD, and that this relationship is exacerbated for those who play for longer per day, and for those that continue to live with their parent/s depending on their culture. Such findings will be useful in identifying IGD risk populations and in guiding early and more targeted intervention and treatment goals in a more culturally responsive way.

Note 1: Baseline survey included 464 valid responses. A total of 94 responses from an initial pool of 558 were removed due to missingness on all scale related variables. Six responses were removed due to non-independence (same subject taking the baseline survey multiple times). The total n for baseline responses was 458.

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